Introduction

1.1 Background

A Supply Chain (SC) is a network of firms that produce, sell and deliver a product or service to a predetermined market segment (Chopra and Meindl, 2004). The SC includes suppliers, manufacturers, distributors, transporters, warehouses, all functions involved in fulfilling a customer request and customers themselves. Each stage of the SC performs different processes and interacts with other stages of the SC. Supply Chain Management (SCM) is one of the fastest growing and well appreciated management disciplines in the world. It consists of management of product flow, information flow, fund flow and services flow internal to an organization and between organizations to fulfill a customer requirement along with reasonable targeted profit. The parameters which show the need for SCM are: i) pervasiveness ii) interdependence iii) profitability and survival. Pervasiveness means every organization makes a product or provides a service that someone values or is used by some other organization. Most of the organizations function as part of
an SC knowingly or unknowingly. It means that all these organizations are to be interdependent one way or the other. Profitability and survival indicates that all the organizations must carefully manage their operations to work together with other interrelated organizations for long term prosperity and survival. SCM philosophy includes the following: i) the entire SC is a single integrated entity, ii) the cost, quality and delivery requirements of customer are shared by every company in the chain and iii) inventory is the last resort for resolving supply and demand imbalance between the levels in the SC. The objective of an SC is to maximize the overall value generated. The value an SC generated is the difference between what a final product is worth to the customer and the effort the SC expends in filling the customer’s request (Chopra and Meindl, 2004). For most commercial SCs, Value will be strongly correlated with SC profitability, the difference between the revenue generated from the customer and the overall cost across the SC. However, the process of maximizing the SC profit is to be implemented by ensuring the satisfaction of customers as well as SC members without which the business will not run for long. One of the emerging trends in the SCM is the realization that long term strategic and operational partnerships among the players in the SC through combination of various appropriate coordination mechanisms are essential for improving the performance, responsiveness and also to achieve satisfaction among members of the SC. Supply Chain Coordination (SCC) among various departments of an organization and between organizations are essential to achieve these SC objectives. Achieving coordination is a big challenge for any SC as it may involve multiple firms with different policies, priorities and objectives. Coordination with in an SC is a strategic response to the problems that arise from inter-organizational dependencies within the chain and a coordination mechanism is a set of methods used to manage interdependencies between organizations (Xu and Beamon, 2006). The decision taken by any SC member
will affect the performance of the other members and finally the SC. This shows the significance and necessity to study coordination in SC.

1.2 Evolution of Supply Chain Management

Figure 1.1 shows the evolution of SCM. During early 1900s, the business decisions were taken based on some thumb rules and there was no scientific approach to manage the business. At that time, it was successful to a certain extent as there was no competition at all and each firm was a monopoly in their area of operation. Afterwards, the uncertainty in demand and other operating parameters with an element of competition induced the researchers and practitioners to search for new methods and procedures to manage the unexpected situations. Thus, the lot sizing techniques were developed for continuous and independent demand items to decide on the optimal order quantity and the proper time at which order is to be placed. Accordingly, the concept of Material Requirement Planning (MRP) was introduced for determining the quantity and timing for the acquisition of dependent demand items needed to satisfy Master Production Schedule (MPS) requirements which give formal details of the production plan and converts this plan into specific material and capacity requirements. Then, the requirement of an element of coordination to synchronize all the aspects of business in an organisation was aroused. Manufacturing Resource Planning (MRP-II) system is then evolved to coordinate sales, purchasing, manufacturing, finance and engineering by adopting a focal production plan and by using one unified data base to plan and update the activities in all the systems. The evolution of IT created a revolution in the world of business. One of the reasons for this revolution is that with the support of IT, people developed a technique called Enterprise Resource Planning (ERP), an extremely powerful tool which provides seamless information system to support the various functional business modules of an
enterprise. ERP package, if chosen correctly, implemented judiciously and used efficiently, will raise the productivity and profit of the companies dramatically (Telsang, 2005). To complete a business successfully, a number of activities and organizations are involved and people come to know that just with the improvement in an organization will not result in complete success for which coordination is required among all the organizations involved in fulfilling a customer request. Finally, the concept of ‘Supply Chain’ (SC) evolved to cater to the required coordination thereby improving the overall performance, avoiding individual optimization.

Figure 1.1: Evolution of supply chain management

1.3 Supply Chain

A supply chain is an integrated system consists of many independently managed organizations acting together for a common goal, with each organization dependent on the performance of the other organization in the system. Generally, supply chain consists of different functions: logistics, inventory, purchasing and procurement, distribution, forecasting, production planning, intra-and inter-organizational relationships and performance measures.
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(Arshinder et al., 2008). The term supply chain forms the picture of how organizations are linked together. Figure 1.2 shows an overview of SC which consists of three divisions; supply/inbound logistics, production, distribution/outbound logistics. In depth analysis shows that third party logistics, distributors and warehouses are also some of the important elements of SC. The information flow is bidirectional as the information from each stage of the SC is required everywhere in the system. Product flow is only in forward direction as no product will flow backward normally, except in the case of some special situations, such as buyback or service, etc. Money flow is in backward direction as payment is made by all upstream (e.g. retailer to wholesaler/distributor) players to its downstream players in an SC. Regarding service flow, its direction is forward as upstream stage always provide service to its downstream players and finally to customers.

Figure 1.2: Overview of supply chain

Figure 1.3 shows the typical entities, objectives and overall concept of an SC. It also differentiates the whole SC into upstream and downstream
players. It also provides the various parameters, such as product, price, store, quantity, customer, and time to be considered for achieving maximum profits. The mismatch between supply and demand is shown in the Figure 1.3. The aim is to match supply and demand profitably for products and services for which all the resources and facilities of SC should work jointly in all aspects.

- **A supply chain consists of**
  - Supplier
  - Manufacturer
  - Distributor
  - Retailer
  - Customer

- **Aims to Match Supply and Demand, profitably for products and services**

- **Achieves**
  - The right Product
  - The right Price
  - The right Store
  - The right Quantity
  - The right Customer
  - The right Time
  - Higher Profits

**Figure 1.3: Concept of a supply chain**

### 1.3.1 Structure of the Supply Chain

Figure 1.4 shows the typical structures of an SC. The first one is a dyadic SC which consists of only a buyer and a seller. Serial structure is one in which there will be only one firm at each level of SC. In the case of a convergent structure, there will be more than one firm existing at all levels except in the extreme right end of the SC where it has got only one player. Divergent structure is just opposite to that of the convergent SC as shown in Figure 1.4. Conjoined structure is one in which only one player will be in the
middle (e.g. manufacturer) and more number of players will be there on both the sides. Network SC is the most general type and has got more than one player at every stage of the SC.

1.3.2 Decision phases in a Supply Chain

The decision phases in an SC can be categorized in two ways based on i) the frequency of each decision and the time frame for which decision is taken and ii) its functions and they are shown in Figure 1.5.
The first type categorization (temporal) of SC decision phases includes SC strategy or design, SC planning and SC operation respectively. During SC strategy or design phase, the details such as structure of SC, its configuration, resource allocation, the process each stage will perform and the period for which these details are designed are decided as per the requirement. These decisions are long term and expensive to alter immediately. So, the uncertainty in anticipated market conditions over the next few years is to be taken into account for deciding the details mentioned above. The SC planning phase includes decisions regarding which markets will be supplied from which locations, the subcontracting of manufacturing, the inventory policies and the timing and size of sales promotions. These decisions based on the first phase (SC design) define the set of operating policies that govern short term operations. The SC operation phase makes decisions regarding individual customer orders on daily or weekly basis based on the design and planning phase. The goal during this phase is to exploit the reduction of uncertainty and to optimize performance (Chopra and Meindl, 2004).
The second type of categorization (functional) includes procurement, production, distribution, and logistics. Procurement is concerned with a firm’s total supply system (internal and external), supplier qualification and selection, optimal procurement policy, vendor managed inventories, and monitoring of continuous improvement in the SC. Production decisions include process design, capacity planning and scheduling, inventory management, manpower management, and quality of products. Distribution refers to the steps taken to move and store a product from the supplier stage to customer stage in the SC. Distribution network design based on the customer needs that are to be met and cost of meeting this customer needs is the major activity under this function. Logistics decisions consist of all activities related to warehousing and transportation throughout the SC.

### 1.3.3 Supply Chain: Process Views

An SC is a sequence of processes and flows that take place within and between different stages and combine to fill a customer need for a product. There are two different ways to view the process performed in an SC.

i. **Cycle view:** The process in an SC is divided into a series of cycles; each performed at the interface between two successive stages of an SC. Figure 1.6 shows the cycle view of an SC. Each cycle includes all processes directly involved in receiving and fulfilling the order from the downstream player. The cycle view of the SC is very useful when we consider operational decisions because it clearly specifies the roles and responsibilities of an SC. The detailed process description of an SC in the cycle view forces an SC designer to consider the infrastructure required to support these processes. (Chopra and Meindl, 2004).
ii. Push/Pull view: The processes in an SC are divided into two categories depending on whether they are executed in response to a customer order or in anticipation of customer orders. Pull processes are initiated with a customer order whereas push processes are initiated and performed in anticipation of customer orders. All processes in an SC fall into one of these two categories depending on the timing of their execution relative to end customer demand. Figure 1.7 shows the push/pull process of an SC. A push/pull view of the SC is very useful when we consider strategic decisions relating to SC design. (Chopra and Meindl, 2004).
1.3.4 Supply Chain: A Macro View

All supply chain processes in a firm can be classified into the following three macro processes and integration of these three macro processes is crucial for successful SCM

i) Customer Relationship Management (CRM): All processes that focus on the interface between the firms and its customers.

ii) Internal Supply Chain Management (ISCM): All processes that are internal to the firm

iii) Supplier Relationship Management (SRM): All processes that focus on the interface between the firms and their suppliers.

The above three macro processes manage the flow of information, product, funds, services required to generate, receive, and fulfill a customer request. (Chopra and Meindl, 2004).

1.3.5 Supply Chain Performance and Strategic Fit

A company’s competitive strategy defines the set of customer needs that it seeks to satisfy through its products and services and the SC strategy is to create the required policies, resources and facilities to meet the competitive strategy. It means that SC strategy has to be designed based on competitive strategy. Strategic fit means that both the competitive and SC strategies have the same goal and it is very critical to a company’s overall success. The tradeoff between efficiency and responsiveness of an SC is to be decided as per the nature of the business and customer needs and the SC is to be designed accordingly. Responsiveness is the ability to handle dynamic nature of the business. Efficiency means the ability to meet the customer requirement with minimum resources. In the present dynamic and competitive business environment, it is crucial that strategic fit should have agile intercompany
scope. Agile intercompany scope refers to a firm’s ability to achieve strategic fit while partnering with SC stages that change over time. The level of agility becomes more important as the competitive environment becomes more dynamic.

1.3.6 Supply Chain Performance Measures and Tools: A Classification

Performance measurement is generally defined as the process of quantifying the efficiency and effectiveness of action (Neely et al., 1995). Effectiveness is the extent to which customer’s requirements are met, while efficiency measures how economically a firm’s resources are utilized to achieve a predetermined level of customer satisfaction. Surveying the literature revealed that there are generally two classes of supply chain performance management (SCPM) systems: Financial (e.g., Traditional financial accounting, Activity Based Costing, and Economic Value Added approach) and Non-financial (e.g., Supply Chain Balanced Score Card, Supply Chain Operations Reference Model) (Agami et al., 2012). Financial performance measurement systems are generally referred to as traditional accounting methods for measuring supply chain performance. Logistic Scoreboard belongs to perspective-based measurement system (PBMS). The parameters that are used to measure the performance of supply chain can be classified based on following supply chain activities or operations (i) order plan (ii) sourcing, (iii) make/assemble, and (iv) delivery/customer (Gunasekaran, et al., 2004). For a detailed discussion of the above, refer Chapter 2 section 2.8

1.3.7 Supply Chain Drivers and Obstacles

A company can improve its performance in terms of responsiveness and efficiency by properly analysing and implementing four drivers of SC performance: facilities, inventory, transportation and information. These drivers not only determine the SC performance in terms of efficiency and
responsiveness but also determine whether strategic fit is achieved across the SC. Once the SC strategy is made based on the competitive strategy, decision has to be taken on these four drivers based on the required level of responsiveness and efficiency for the existing SC structure.

The obstacles to achieve strategic fit are: i) increasing variety of products ii) decreasing product life cycle iii) increasingly demanding customers iv) fragmentation of SC ownership v) globalization vi) difficulty in executing new strategies. These obstacles are a very common phenomenon in the present business scenario. Overcoming these obstacles offers a tremendous opportunity for firms to use SCM to gain competitive advantage. This kind of situation necessitates combination of appropriate mechanisms and policies to achieve coordination between firms and to be an agile SC.

1.4 Matching Demand and Supply in a Supply Chain

The dynamic mismatch between demand and supply is big challenge for any SC where forecasting plays an important role. The forecast of demand forms the basis for all strategic and planning decisions in both an enterprise and an SC. Collaborative forecasting for an entire SC will be really a result oriented approach for decision making as it greatly increases the accuracy of forecasts and maximizes the SC performance.

Aggregate planning is a process by which a company determines levels of capacity, production, subcontracting, inventory, stock out, and even pricing over a specified time horizon. The role of aggregate planning is to meet the demand in such a way that it maximizes the profit. It is most important to perform aggregate planning under conditions where capacity is limited and lead times are long. Aggregate planning has a significant impact on SC performance and must be viewed as an activity that involves all SC partners.
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The variation in demand over a time horizon has two components: predictable and unpredictable. Predictable variability is the change in demand that can be forecast. It can be managed using capacity, inventory, subcontracting, backlogs, short term price discounts and trade promotions. As far as supply is concerned, a firm can alter it by controlling a combination of production capacity and inventory.

1.5 Inventory Management in a Supply Chain

Inventory management is a planned approach of determining what to order, when to order, how much to order and how much to stock so that the cost associated with buying and storing are optimal without interrupting production and sales. The two major costs associated with inventory are ordering cost, and inventory carrying cost. Inventory carrying cost is the sum of holding cost (interest on capital) and storage cost (other costs such as rent, product deterioration and obsolescence, insurance etc). But in some cases, the term holding cost is only used to represent both holding cost and storage cost where storage cost may not have much importance. These two costs (inventory carrying cost and order cost) are opposing costs. So, the right quantity to be ordered is that strikes a balance between the two opposing costs. This quantity is referred to as Economic order quantity (EOQ). EOQ is that order quantity which minimizes the total cost i.e the sum of annual ordering and inventory carrying cost (Telsang, 2005).

Inventory exists in the SC because of mismatch between supply and demand. An important role that inventory plays in an SC is to increase the amount of demand that can be satisfied by getting products ready and available when the customer wants them. Another significant role inventory plays is to reduce cost by economies of scale that may exist during both production and distribution. Cycle inventory is the average amount of inventory used to satisfy
demand between receipts of supplier shipments. The size of the cycle inventory is the result of the production or purchase of material in large lots. Companies produce or purchase in large lots to exploit economies of scale in the production, transportation, or purchasing process. So, decision on cycle inventory must be taken comparing the ordering cost and holding cost of the product. The key managerial levers for reducing lot size and thereby the cycle inventory in the SC without increasing cost are i) reduce the fixed ordering cost and transportation cost per order ii) implement volume based discounting schemes rather than individual lot size based discounting schemes iii) eliminate or reduce trade promotions and encourage everyday low pricing (ELDP) and base trade promotions on sell-through rather than sell-in to the retailer. Safety inventory is one that is held to meet the unexpected demand. The required level of safety inventory is lower in the case of continuous review policies than periodic review policies. The required level of safety inventory may be reduced and product availability may be improved if an SC can reduce demand variability, replenishment lead times and exploit aggregation. Seasonal inventory is one to meet the seasonal variations in demand.

One of the strategies for aggregate planning to improve the SC performance is the level strategy. Level strategy is one in which Inventories that are built up in anticipation of future demand or backlogs are carried over from high to low demand periods maintaining stable machine capacity and workforce levels with a constant output rate. Level strategy should be used when inventory holding and backlog costs are relatively low

1.6 Sourcing in a Supply Chain

Sourcing is the entire set of business processes required to purchase goods and services. It includes the selection of suppliers, design of supplier contracts, product design collaboration, and procurement of material and
evaluation of supplier performance. Over the last decade, manufacturing firms have increased the fraction of purchased parts. Effective sourcing decisions thus have a significant impact on financial performance. Supply contracts, such as buy back, revenue sharing, quantity flexibility contracts, price discounts, two-part tariff & threshold contracts, revenue sharing, and design collaboration, improve the coordination and thereby the effectiveness of sourcing process. The following steps that can be taken to make the sourcing decisions effective in practice are: i) use the multifunctional teams to make result oriented strategy in all aspects ii) ensure appropriate coordination across regions and business units ii) always evaluate all the factors that influence the total cost of ownership and use for supplier selection iii) build long term relationship with key suppliers.

1.7 Transportation operations in a Supply Chain

Transportation refers to the movement of product from one location to another within the SC. The importance of transportation has grown with the increasing globalization in SCs as well as growth in e-commerce because both trends increase the distance product travel. Transportation decisions impact SC profitability and facility decisions within the SC. When designing transportation networks, shippers must consider the tradeoff between transportation cost, inventory cost, operating cost and customer responsiveness. The SC goal is to minimize the total cost while providing the desired level of responsiveness to customers.

1.8 Pricing and Revenue Management in a Supply Chain

Revenue management uses differential pricing to better match supply and demand and increase the SC profits. Traditionally, firms have changed the availability of assets to match the supply and demand. But in the modern approach, pricing is used as a lever to reduce the mismatch between supply and demand and it is an easier one to do it, compared to an investment in SC assets.
Revenue management increases firm’s profits by using differential pricing mechanism properly and retaining the valuable customers more satisfied through greater asset availability. It is effective for multiple customer segments each placing different values on the SC asset, perishable items, seasonal demand and bulk & spot customers. Optimization is to be applied in each case to obtain effective revenue management decision.

1.9 Coordination in a Supply Chain

The decisions, policies, actions or approaches of SC partners which lead to the benefit of the entire chain can be termed as SC coordination and it is essential for the success of SCM. Lack of coordination occurs if different stages of SC focus on optimizing their own objectives or if information is distorted as it moves across the SC. The effect of lack of coordination affects manufacturing cost, inventory cost, replenishment rime, transportation cost, labour cost for shipping and receiving, level of product availability and relationships across the SC adversely. That means the overall performance of SC is affected adversely due to lack of coordination. The awareness about the common obstacles to SC coordination is required to manage the same. Local optimization within functions or stages of an SC, improperly structured sales force incentives, information sharing obstacles, operational obstacles and pricing obstacles are some of the important issues of SC coordination. The method to achieve coordination among SC members is to implement appropriate coordination mechanisms, such as SC contracts, joint decision making, and information sharing and information technology. The managerial levers to achieve coordination are: i) aligning goals and incentives ii) improving operational accuracy iii) improving operational performance iv) designing pricing strategies to stabilize orders and v) building partnership and trust. The last one is a
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qualitative coordination mechanism and it is required throughout the SC along with any other mechanism for the overall success of any SC.

SC contracts are one of the major categories of coordination mechanisms. Appropriate SC contacts provide a platform to enable SC to resolve almost all issues among their partners. Designing and implementing effective contacts is a great challenge and it is one of the factors that decide the success of any SC. The key steps in designing effective SC partner ships are: i) assessing the value of the relationship to highlight the contribution of each player and expected benefits for each player ii) identifying the operational roles and decision rights for each party to acknowledge the roles, responsibilities and authority of each player in SC iii) creating effective contracts to get the expected results iv) designing effective conflict resolution mechanism to manage any dispute on any issue raised by any player in the SC. Price discounts, delay in payments, buy back, revenue sharing, and quantity flexibility contracts are some of the examples of SC contacts.

Information sharing is one of the major coordination mechanisms and SC partners can benefit by sharing information on sales, demand forecasts, inventory levels and marketing campaigns. Inaccurate and distorted information leads to a phenomenon where the fluctuation in orders increases as they move up the SC from retailers to wholesalers to manufacturers to suppliers and it is called bullwhip effect. The bullwhip effect reduces the profitability of an SC by making it more expensive to provide a given level of product availability. Figure 1.8 shows the occurrence of bullwhip effect in an SC.

Building strategic partnership and trust within an SC is very important for the effective implementation of any other coordination mechanism. The presence of flexibility, trust, and commitment in all parties helps an SC relationship to succeed. Good organizational arrangements, especially for
information sharing and conflict resolution, improve chances of success. The success of any SC relationship depends how fairly a stronger player treats the weaker. The issue of fairness is extremely important in the SC context as most of the relationships will involve parties with unequal power. SC relationships are either based on power or trust and trust based relationship will sustain for long with fruitful results and others may collapse at any time. The trust between SC partners can be developed over time as a result of a series of interactions.

**Observation of presence of Bullwhip effect**

![Figure 1.8: Order fluctuations at different stages of Supply Chain (Chopra and Meindl, 2004)](image)

The importance of information technology (IT) in an SC is very high in the present business environment. Information is the driver that serves as the glue to create a coordinated SC. IT provides the tool to gather this accurate information on time and to analyse it to make the best SC decision. IT supports us to enable the interaction between organizations and with customers. Proper IT systems not only allow the collection of accurate data on time across the SC, but also the analysis of decisions that maximize the SC profitability. E-business
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is an application of IT and it is the execution of business transactions through the internet. E business makes all the process in a firm as well as in entire SC more responsive and efficient.

1.10 The Problem

The research on SCM is strongly related to SCC. It indicates the importance of this area without which complete success of SCM is not possible and hence SCC can be considered as the backbone of SCM. The various steps to achieve the SCC in practice are: i) understand the existing SC ii) list out the areas of lack of coordination iii) analyse the obstacles iv) identify the appropriate coordination mechanism v) apply modelling and analysis to understand the effect of coordination mechanism vi) get top management commitment for implementing the same vii) get resources for coordination viii) focus on communication between all stages and try to achieve it in the entire SC network ix) use technology to support the coordination mechanism x) share the benefits of coordination equitably xi) maintain the relationship and trust among SC members for long term success. The importance of coordination to improve the SC performance emphasizes the necessity to explore various issues of SCC to make the concept and practice of SCM more useful to all the users.

Because of the above, it is required that the study of the effect of various categories of mechanisms individually and in combination under different business cases be carried out to ensure strong SCC among SC members and thereby to improve SC performance. Supply chain contracts and Information sharing are two categories of mechanisms considered in this study to enhance the coordination and thereby to improve the performance. Under supply chain contracts, price discount and delay in payment are the two mechanisms considered individually and in combination. Because, customers are more familiar and easily attracted or motivated as both the mechanisms provides
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direct monetary benefits and hence firms are more concerned about these two mechanisms. Information sharing is the backbone of all other coordination mechanisms as it supports all the activities or operations to perform well. Different cases of information sharing are used separately and a combination of all in one. When confronted with the problem of choosing the coordination mechanisms, we have given importance to choosing simple and more widely used mechanisms in this study.

Accordingly, the problem for this research work was formulated and decided to study the following.

- Effect of combination of ‘price discount’ and ‘delay in payment’ on SC performance on a three level SC
- Effect of ‘price discount and delay in payment’ individually and jointly on a dynamic networked SC
- Effect of various types of information sharing on SC performance and the comparison between each other in detail using simulation game with live players.
- Effect of above mentioned coordination mechanisms on SC performance under lost sale and backorder cases
- Sensitivity of system parameters on supply chain performance.

1.11 Objectives of this Research Work

The importance of supply chain coordination and mechanisms found during the literature survey motivated us to select the same as the topic for the research. To solve the problems mentioned above, the following primary objective was targeted and to meet the primary objective, studies were conducted with certain secondary objectives as follows.
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Primary Objective
• To study the performance of a multi-level supply chain while using selected coordination mechanisms

Secondary Objectives
• To study the performance of a three level supply chain while using ‘price discount and delay in payment’ jointly as coordination mechanisms using mathematical modelling.
• To study the performance of a three level networked supply chain while using ‘price discount and delay in payment’ jointly as coordination mechanisms under lost sale and backorder cases using simulation modelling.
• To study the performance of a four level supply chain using ‘Information sharing’ as coordination mechanism under lost sale and backorder cases using a simulation game with live players

1.12 Structure of the Thesis

The structure of the remaining part of the thesis of this research is given in this section. The whole thesis is divided into six chapters. The second chapter of this thesis deals with ‘literature review’ in the area of supply chain coordination (SCC) & mechanisms. The third chapter explains the performance of a three level SC while using ‘price discount and delay in payment’ jointly as coordination mechanisms using mathematical modelling. The fourth chapter describes the performance of a three-level dynamic networked SC while using ‘price discount and delay in payment’ jointly as coordination mechanisms under lost sale and backorder cases using simulation modelling. The fifth chapter discusses the performance of a four level SC using ‘information sharing’ as coordination mechanism under lost sale and backorder cases using a simulation game with live players. The sixth chapter focused on the limitations, overall conclusion and scope for future research.

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